

Algebra, Equations, and Inequalities

* The "basic law" of algebra is that if you do an operation to one side of an equation, then you must do the same thing to the other side. These operations include, but are not limited to addition, subtraction, multiplication, division, and exponentiation (which includes flipping, roots, etc.).

Example:

$$3x = 9$$

After dividing both sides by 3:

$$x = 3$$

* The FOIL (First, Outer, Inner, Last) Method:

$$(x + 5)(x - 2) = x^2 - 2x + 5x - 10 = x^2 + 3x - 10$$

* FOIL Shortcuts:

-- The difference of two squares: $x^2 - y^2 = (x + y)(x - y)$

-- Binomial squares: $(x + y)^2 = x^2 + y^2 + 2xy$

* The "overall goal" of algebra is to "solve for x", or the value of some other variable, such as "y". You want to isolate the variable on one side of the equation (in the form "x"), and end up with something that reads like "x = 5y + 4".

* Let's say that you have two simultaneous equations, with variables "a" and "b":

$$2a + 4b = 17$$

$$3a - 2b = 8$$

Use the first equation to find the value of "a" in terms of "b":

$$a = \frac{17 - 4b}{2}$$

Use the second equation, with the value of "a", "in b's", derived from the first equation, to find the value of "b". **This equation should not have any a's in it:**

$$3\left(\frac{17 - 4b}{2}\right) - 2b = 8$$

$$b = \frac{35}{16}$$

Go back to the first equation, using this value of "b", to find the value of "a":

$$2a + 4\left(\frac{35}{16}\right) = 17$$

$$a = \frac{33}{8}$$

You now have the values of both "a" and "b", and can use them to check your work, by plugging these values into both of the original equations.

* Inequalities are just like equations, with one key difference: the symbol separating the two sides is not an equals sign. There is another important difference: if you multiply or divide both sides of an inequality by a negative number, change the symbol to its opposite ("Flip and negate!").

Symbol	Opposite
\neq	\neq
$<$	$>$
\leq	\geq

Example:

$$-2x > -12$$

After dividing both sides by -2:

$$x < 6$$